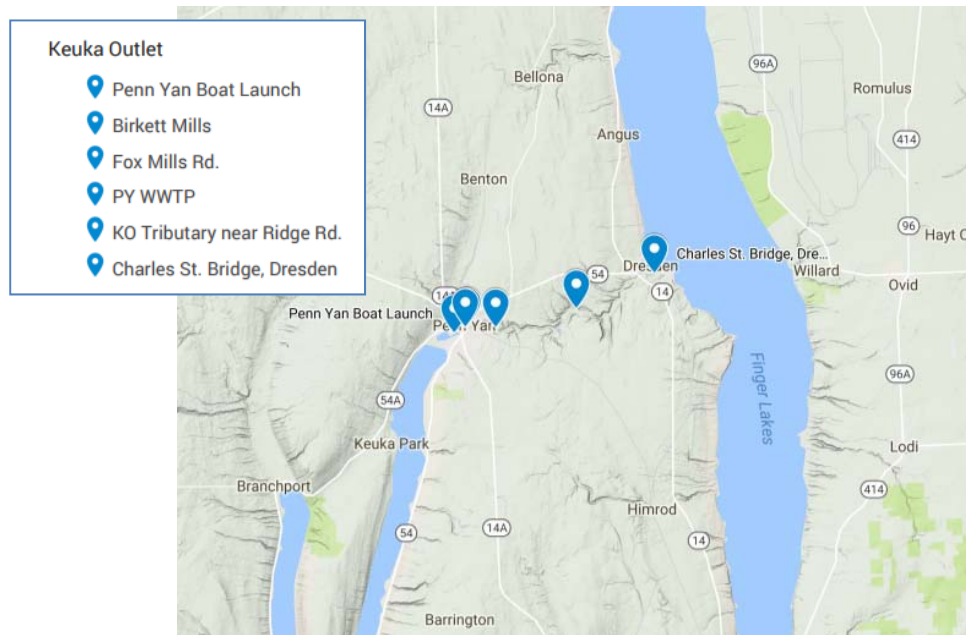


Description of Keuka Outlet

Keuka Outlet is the largest tributary to Seneca Lake, with its watershed area representing 35% of the Lake's total area. It is the sole outlet of Keuka Lake, and flows northeast from Penn Yan to Dresden, on the central western shore of Seneca Lake. Flow from Keuka Lake is controlled by gates in a dam at Penn Yan. The drainage area into the outlet, not including Keuka Lake, is 79% agriculture and 16% forested land. The outlet has a long history of mills and other industry on its shores, and has historically functioned as a canal for water transport between the two lakes.

SPWA Water Sampling Locations

SLPWA has sampled the outlet since 2015, beginning with four locations from the discharge of Keuka Lake to Dresden, near the mouth at Seneca Lake. Two sampling locations were added in 2016, one at the confluence of Jacobs Brook in Penn Yan at the Birkett Mills plant site, and the other at the discharge outfall of the Penn Yan Wastewater Treatment Plant (WWTP). Sampling is typically performed 4-5 times per year spring through fall.






Waterbody Classification and Contamination Sources

The Keuka Outlet stream is a DEC Class C fishing stream. Much of the flow through the outlet comes from Keuka Lake, which has consistently good water quality. The high level of agricultural land use of the outlet watershed is likely a source of elevated nutrients and bacteria concentrations seen downstream of Keuka Lake. The Penn Yan WWTP effluent is also a source of nutrients and bacteria, neither of which are regulated by its DEC SPDES permit. SLPWA has also tested for metals contamination from the Lockwood Landfill, near Dresden, which served as the ash disposal site for the Greenridge coal fired power plant. A major clean-up project on the outlet is projected to extend into 2018. Dredging of residual waste from a former manufactured gas plant is being done under the control of the NYS DEC.

Water Quality Summary

SLPWA conducts water quality testing at six outlet locations, sampling approximately five times every summer. Tests include bacteria (*E. Coli* and total coliform), nutrients (phosphorus and nitrogen), dissolved oxygen, and total suspended solids--a measure of water clarity. These tests provide information on the water quality status of the outlet and how it may affect Seneca Lake. The table below provides parameters of particular concern and the compliance with established guidance or DEC limits.

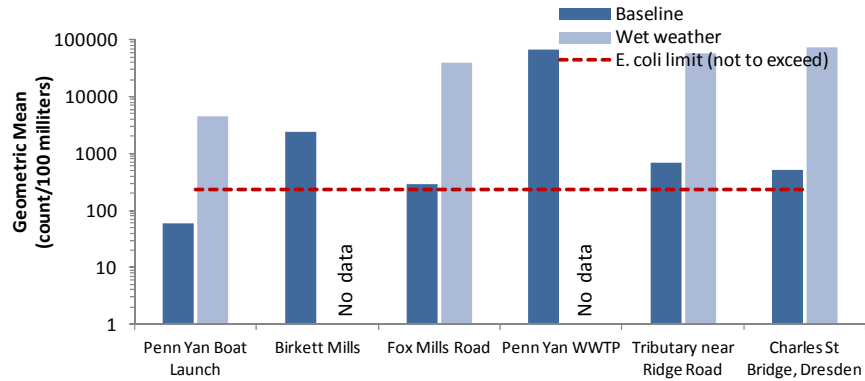
Parameter tested	Why is it measured?	% of water samples meeting guidelines in Keuka Outlet	Is there a potential concern for Seneca Lake water quality?
Bacteria - <i>E. Coli</i>	To evaluate bacterial water quality impact of septic systems, wastewater treatment plants, and animal waste entering the creek	 <p>68% of samples fail to meet limits</p> <p>32% of samples meet limits</p>	Yes. Less than one-third of bacteria samples collected meet DEC limits for swimming.
Total Phosphorus	To evaluate the impact of agricultural and residential phosphorus runoff that can cause excessive algae growth.	 <p>93% of samples fail to meet limits</p> <p>7% of samples meet limits</p>	Yes. Less than 10% of phosphorus samples meet the phosphorus guideline.
Dissolved Oxygen (mg/L)	To evaluate the impact of erosion, agricultural or residential runoff or algal growth that can increase oxygen demand, removing oxygen needed by fish and other wildlife.	 <p>100% of samples meet limits</p>	No. Dissolved Oxygen values meet limits at all Outlet locations.

Highlights of Monitoring Results

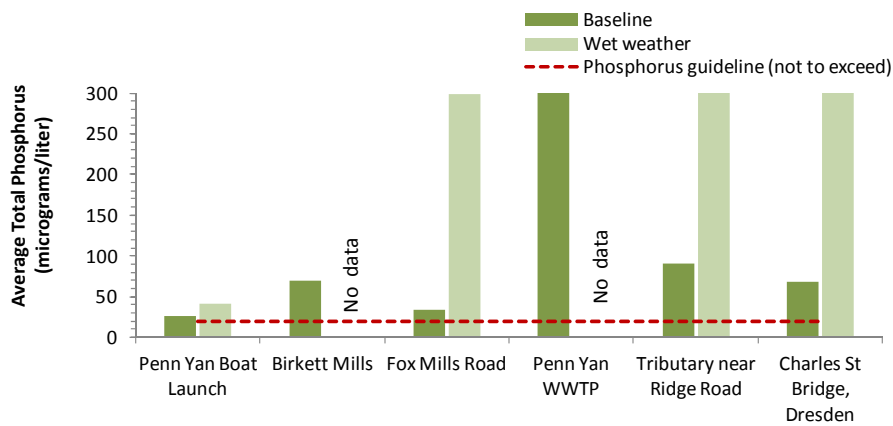
- Results for phosphorus and nitrogen (nutrients that encourage plant and algae growth), and *E. coli* bacteria (an indicator of human and animal wastes) are the most concerning of the parameters tested.
- Phosphorus levels at normal stream flow conditions are reasonable, at one to two times the DEC guidance level of 20 ug/l, which is consistent with the good water quality of Keuka Lake waters. During the one storm event tested during the monitoring period, phosphorus levels increased dramatically to approximately twenty times the guidance level. High flow levels combined with high levels of nutrients results in a substantial increase in nutrients flowing into Seneca Lake, exacerbating excessive weed and algae growth.
- *E. coli* bacteria concentrations increase moving downstream from Keuka Lake to Seneca Lake at normal flow levels, approaching the swimming limit of 235 colonies/100 mL. Of particular concern is the dramatically high levels seen during higher flow events, in which bacteria concentrations increased 300-fold.
- Sampling of the Penn Yan Waste Water Treatment facility has shown very high levels of bacteria and nutrients.

Keuka Outlet Water Quality by Location, 2014 - 2016

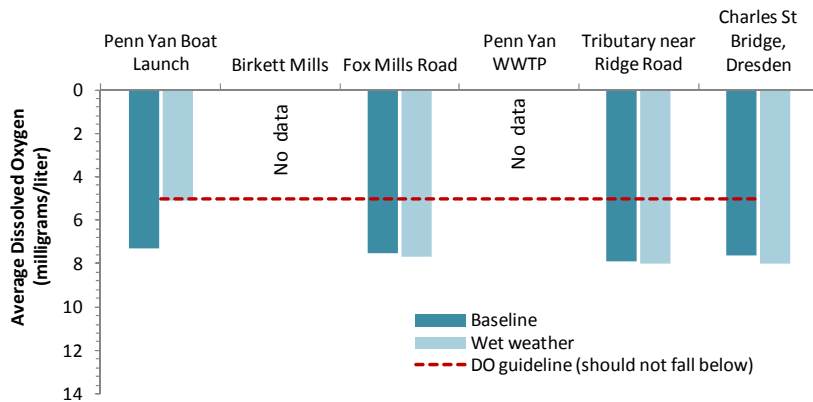
E. COLI BACTERIA (note log scale)



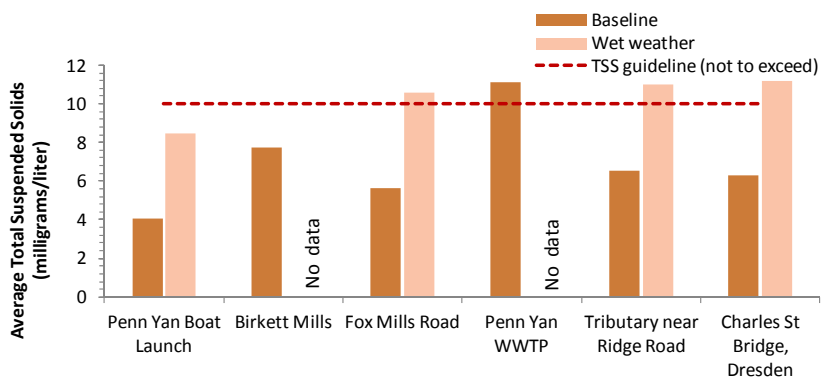
PHOSPHORUS



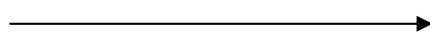
DISSOLVED OXYGEN



TOTAL SUSPENDED SOLIDS



Upstream



Downstream (near lake confluence)